WASHINGTON STATE BUILDING CODE COUNCIL
APPLICATION FOR REVIEW OF A PROPOSED STATEWIDE AMENDMENT TO THE WASHINGTON STATE BUILDING CODE

2012 Code Adoption Cycle

Log # _____
(office use only)

PLEASE FOLLOW INSTRUCTIONS ON PAGE FIVE

1. State Building Code to be Amended:

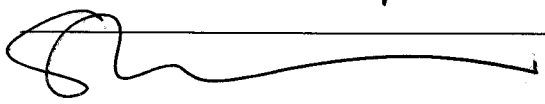
	International Building Code	X	State Energy Code
	International Residential Code		International Mechanical Code
	ICC ANSI A117.1 Accessibility Code		International Fuel Gas Code
	International Fire Code		NFPA 54 National Fuel Gas Code
	Uniform Plumbing Code		NFPA 58 Liquefied Petroleum Gas Code

Section: 2012 WSEC C402.3.1.1 **Page:** TBD

2. Applicant Name (Specific local government, organization or individual):

Eric Vander Mey, P.E., LEED AP, Rushing Company
Hamilton Hazlehurst, Vulcan, Inc.

3. Signed:

Proponents	**Titles**	**Date**
	Principal	March 1, 2013
 (Sharon Coleman on behalf of Hamilton Hazlehurst)	Director, Real Estate Development	March 1, 2013

4. Designated Contact Person:

Eric Vander Mey, P.E., LEED AP — **Name**
Principal — **Title**

Address: 1725 Westlake Ave N, Suite 300
Seattle, WA 98109

Office Phone: 206-285-7114 **Cell:** 206-321-1677 **Fax:** 206-285-7111

e-mail address: ericv@rushingco.com

5. Proposed Code Amendment. Use 'legislative format' including both old and new language. **See instructions on page five for specific details.** Please use a separate sheet for each separate proposal.

Code: 2012 WSEC **Section:** C402.3.1.1 **Page:** TBD

Amend section to read as follows:

Add the following definitions to Section C202:

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the *conditioned space*.

CONDITIONED FLOOR AREA, ADJUSTED. The horizontal projection of the floors associated with the *adjusted conditioned space*.

CONDITIONED SPACE. An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space*

CONDITIONED SPACE, ADJUSTED. An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space* that is not one of the following spaces:

1. Below Grade *Conditioned Spaces*
2. Elevator Hoistway Shafts
3. Shafts
4. Mechanical Rooms
5. Elevator Machine Rooms
6. Electrical Rooms
7. Storage Rooms, Unoccupied
8. Janitor Closets
9. Trash Rooms
10. Elevator Lobbies, that are not directly adjacent to an above grade wall that is part of the building envelope
11. Stairwells, that are not directly adjacent to an above grade wall that is part of the building envelope
12. Corridors, that are not directly adjacent to an above grade wall that is part of the building envelope
13. Toilet Rooms, that are not directly adjacent to an above grade wall that is part of the building envelope

Make the following changes to C402.3:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

C402.3.1 Maximum area. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not exceed 30 percent of the gross above-grade wall area. The skylight area shall not exceed 3 percent of the gross roof area.

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the *adjusted conditioned floor area* is within ~~a~~ the primary and secondary daylight zones;
2. In other that Group R occupancies ~~A~~automatic daylighting controls are installed in daylight zones or in Group R occupancies automatic daylighting controls are:
   a. Installed for all lights in the daylight zones or
   ~~a.~~b. Provided to control dedicated, labeled receptacles for occupant task lighting for all rooms in the daylight zones; and
3. ~~2.~~ Visible transmittance (VT) of vertical fenestration is greater than or equal to ~~1.1~~ 1.25 times solar heat gain coefficient (SHGC).

Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

For other than Group R occupancies the calculation for the *adjusted conditioned floor area* to primary and secondary *daylight zone* ratio is performed solely based on the definitions of adjusted conditioned floor area and the daylight zone. There is no required consideration for the impact of interior partition layouts within the daylight zones on the daylight zone unless interior partitions are part of the rooms or spaces that are exempted as part of the *adjusted conditioned floor area* definition.

Are additional pages attached? ~~Yes~~ **No**

Please note number of additional pages:

Log # _____
(office use only)

Supporting Data for Statewide Amendment Proposals. This information is required for all statewide amendment proposals. **Attach supporting documentation, as necessary; incomplete proposals will not be accepted.**

The SBCC requires supporting data on any amendment proposal to show:

1. **That it meets basic criteria – See Part I to specify how this proposal meets the criteria for code amendment.**
2. **The intended effect—See Part II to describe the purpose of the proposed amendment, including the benefits and the problems addressed.**
3. **The potential impacts or benefits to business—See Part III/Types of Construction, to explain how methods in construction businesses, industries and services would be affected.**
4. **The potential impact on enforcement procedures, See Part III/Types of Services Required, to provide some analysis of the impacts on code enforcement in local jurisdictions.**
5. **Economic costs and benefits – Use the Table in Part IV of this form to estimate the costs and benefits of the proposal on construction practices, users and/or the public, the enforcement community, and operation and maintenance.**

Part I ❖ Background information on amendment.

Code References: C402.3.1 Title: Maximum Vertical Fenestration Area
Related codes: C202 (Does this amendment change other related codes?)
Proponent: Eric Vander Mey Phone: 206-285-7114 Date: 3/1/2013

NOTE: State-wide and emergency state-wide amendments to the state building code must be based on one of the following criteria; please indicate the pertinent rationale for the proposed amendment by selecting from the list below:

(1) The amendment is needed to address a critical life/safety need.
(2) The amendment is needed to address a specific state policy or statute.
(3) The amendment is needed for consistency with state or federal regulations.
(4) The amendment is needed to address a unique character of the state.
(5) The amendment corrects errors and omissions.

Part II ❖ Amendment Benefit:

PROBLEM(S) ADDRESSED (Describe the intended effect of the proposed code amendment):

Rushing and Vulcan have analyzed the daylighting exception that allows 40% Window to Wall (WWR) ratio of glazing percentage. There are multiple clarifications that need to be made to make this section enforceable by all jurisdictions throughout the state.

Additionally, the calculation for the ratio of the daylight zone area to the conditioned floor area of the building is unfairly weighed toward the conditioned floor area. This is because there are many locations throughout the building including below grade rooms and core areas that are impossible to daylight or receive minor benefits if daylight. These include stairwells, janitor rooms, mechanical rooms, electrical rooms, unoccupied storage rooms, etc.

PRIMARY REASON FOR AMENDMENT: (Describe how the amendment meets one of the criteria listed above)

As the change to 30% WWR was a 2012 IECC it received little attention in the public review phase. It was thought that the 40% WWR daylighting optional compliance path was a viable path to achieving 40% WWR. Upon further analysis this is not the case and would drastically change the floorplan layout of a typical office or multi-family residential project. This would drastically reduce the allowable floor area and increase the SF of exterior wall area driving up the cost per SF of the project.

Reduction of 25% of the WWR ratio (from 40% WWR to 30% WWR) in one code cycle is too great a jump. In order to provide a quality interior environment for office and high-rise residential buildings a minimum of 40% WWR glazing is required. Current studies by Vulcan, Inc shows that the typical glazing percentage is currently around 42% WWR. A similar percentage of glazing is needed for upcoming projects to be viable.

The cost of going to triple pane glazing or the best possible double pane glazing to achieve a typical market required glazing percentage of 40% WWR is not viable in the current economic market. If the 2012 WSEC is not amended this could stall many projects that cannot afford the additional cost of dramatically improved glazing systems to achieve a reasonable vertical wall glazing percentage. The cost increase above what is required if the daylighting exception cannot be utilized to achieve a 40% WWR is approximately an additional 14% to 18%. See attached cost data matrix for details.

The proposed change provides a viable prescriptive path for utilizing the daylighting exception to achieve 40% WWR in buildings. While still maintaining the goal of providing energy savings through lighting energy savings at the spaces that need to use it.

If all buildings need to use the Total Building Performance Path (C407) to achieve a standard glazing percentage this will lead to undue code enforcement cost. Many jurisdictions are not setup to review and enforce the TBP compliance path. Per RCW 19.27A there needs to be multiple viable ways to show code compliance.

The change of the definition to utilize the "adjusted conditioned floor area" provides approximately a 5% allowance on the typical floor. This makes the 50% ratio close to possible. Please note that this is not easily achieved and careful design practice will need to occur to optimize the daylight zone

Avoids moving the band of glazing up in the wall elevation with a lower than typical height to achieve 40% glazing.

Additionally, the proposal clarifies code language to make code language enforceable for different building types including residential vs non-residential and core shell vs built-to-suit non-residential.

The proposal increases the VT to SHGC ratio. Most glazing utilized today for these projects has a visible light transmittance of 50% or greater. With an SHGC of 0.40 in the code baseline this translates to a viable ratio of 1.25 or better.

Many land use zones require high glazing percentages or transparency requirements for retail and other street level amenities. This forces glazing down to the ground level and takes away glazing from the other floors of the building. Until land use codes can catch up to the trend of the energy code to reduce energy consumption by reducing glazing this will be a constant conflict.

See the following data that was provided as backup:

- Cost data of glazing systems
- Analysis of (7) office buildings typical floor layouts for ratio
- Recap of changes to 2012 IECC, 2012 WSEC, and alternate proposals currently being considered for 2012 SEC

TYPE OF BENEFITS PROJECTED:

Similar energy savings to 2012 WSEC as recommended by the SBCC.

Lower enforcement costs with prescriptive ways to comply with the code and achieve a 40% WWR building.

Part III ❖ Amendment Impacts or Benefits:

TYPES OF CONSTRUCTION: ☑ New Construction ☐ Alteration/Tenant Improvement/Repair
☐ Residential-Single Family ☑ Residential-Multi Family ☑ Commercial ☐ Industrial

List businesses/industries affected by amendment:

Manufacturers:	Glazing manufacturers
Specific Construction Contractors & Trades:	Glazing contractors, opaque wall contractors
Construction Supply Industry:	N/A
Specialty Trades:	N/A
Types of Buildings:	Multi-Family Residential, Commercial Office, Commercial other
Fire Protection Industry:	N/A

TYPES OF SERVICES REQUIRED:

☑ **Reporting.** Brief Description:

No impact.

☑ **Record Keeping.** Brief Description:

No impact.

☐ **Other.** Brief Description:

No Impact

☑ **Indirect Cost to Industry**. Indicate whether there are multiple sources to obtain the equipment, material or service required by this proposal.

☐ **Small Business Impact**. If not, provide a justification of the benefit versus small business impact.

Part IV ❖ Amendment Costs and Benefits

	Construction[1]			Enforcement[2]			Operations & Maintenance[3]		
Building Type	Costs	% impact[4]	Benefits[5]	Costs	% impact	Benefits	Costs	% impact	Benefits
Residential									
Single family	NA	NA	NA	NA	NA	NA	NA	NA	NA
Multi-family	Lower	Minimal	Great	Lower	Minimal	Great	None	None	None
Commercial/Retail	Lower	Minimal	Great	Lower	Minimal	Great	None	None	None
Industrial	None	None	None	None	None	None	None	None	None
Institutional	None	None	None	Lower	Minimal	None	None	None	None

See attached cost data in proposal backup information.

[1] $ / square foot of floor area or other cost. Attach data. **Construction** costs are costs prior to occupancy, and include both design and direct construction costs that impact the total cost of the construction to the owner/consumer.

[2] Cost per project plan. Attach data. **Enforcement** costs include governmental review of plans, field inspection, and mediated litigation required for enforcement.

[3] Cost to building owner/tenants over the life of the project.

[4] Cost differential over a specific size project or range of projects as determined by the proponent. Provide sufficient cost and benefit detail to clarify the impact to the Council. All data should be created and referenced to third party reputable sources for verification.

[5] Note sectors with measurable benefit from Part II, including benefits to a) the user, b) the public, c) the industry, and/or d) the economy; use e) for all of the above.

GENERAL INSTRUCTIONS FOR MAKING A CODE CHANGE PROPOSAL:

1. Check the boxes for the code or codes for which amendments are being proposed.
2. Provide the name of the local government, organization, or individual proposing the code change.
3. Proponent must sign and date the proposal as noted.
4. Provide contact information for the person designated to work with the Council and staff to supply information on the proposed changes as needed; please include name, address, phone number and e-mail address.
5. The specific section for which an amendment is proposed should be listed. The **entire section** should be reproduced, including the existing and the proposed amendatory language.

   This must be prepared in legislative style formatting. Specifically, all added words should be underlined; all deleted words should be struck through. Any separate new sections added should be inserted in the appropriate place in the existing code language in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code, additional pages may be attached.
6. **SUPPORTING DATA REQUIREMENTS FOR ALL STATEWIDE AMENDMENT PROPOSALS:** You must attach background information with all statewide amendment proposals. The attached worksheet provides requirements for supporting data. All information will be forwarded to the Council as part of the amendment's documentation. TAG findings and projections from the worksheet will be tabulated to summarize projected benefits and impacts and will be included with TAG comments and recommendations. SBCC staff may request additional information as needed to clarify any potential impacts, and may perform additional research and analysis as needed when requested by the Council or the Standing Committee.
7. Please send an electronic copy of your completed proposal to SBCC staff at: sbcc@ga.wa.gov

NOTE: YOU MAY REPRODUCE THIS FORM AND ADD ADDITIONAL PAGES AS NEEDED.

Glazing Cost Basis Table

Description	Climate Zones	Glazing Description	Code Maximum Vertical WWR Glazing Percentage	Proposed Building Vertical WWR Glazing Percentage	Metal Framed Glazing Max. U-Value	Metal Framed Glazing Max. SHGC	Metal Framed Glazing Min. VT	VT/SHGC Ratio		Vertical Glazing Cost ($/SF)	Opaque Wall Cost ($/SF)	Total Vertical Skin Cost ($/SF)		% Cost Difference from Daylighting Option	% Cost Difference from 2009 WSEC	Notes
2009 WSEC Code 0-40%WWR Baseline Glazing Criteria	1	Curtainwall, Double Pane, 4 Sided Captures Glass with Argon Fill	40%	40%	0.40	0.40	n/a	n/a		$ 78.00	$ 90.00	$ 85.20		-5.0%	Baseline	Notes 1, 5
2012 WSEC Code 0-30%WWR Baseline Glazing Criteria	5 and 4M	Curtainwall, Double Pane, 4 Sided Structural Silicon Glazing with Argon Fill	30%	30%	0.38	0.40	n/a	n/a		$ 82.50	$ 94.50	$ 90.90		1.3%	6.7%	Notes 1, 5
2012 WSEC Code 40%WWR Daylighting Option Glazing Criteria	5 and 4M	Curtainwall, Double Pane, 4 Sided Structural Silicon Glazing with Argon Fill	40%	40%	0.38	0.40	0.44	1.1		$ 82.50	$ 94.50	$ 89.70		Baseline	5.3%	Notes 1, 2, 5
2012 WSEC Target UA 40% Max Glazing Criteria without Daylighting Option	5 and 4M	Curtainwall, Double Pane, 4 Sided Structural Silicon Glazing, 30MM Isolated Strut and Double Low E Coating	30%	40%	0.28 - 0.30	0.30	n/a	n/a		$ 94.00	$ 106.00	$ 102.40		14.2%	20.2%	Notes 1, 5
2012 WSEC Target UA 50% Max Glazing Criteria	5 and 4M	Curtainwall, Triple Pane, Double Low-e Coating	30%	50%	0.23 - 0.25	0.24	n/a	n/a		$ 97.50	$ 109.50	$ 105.90		18.1%	24.3%	Notes 1, 5
2012 WSEC Code Proposal 40% Max Alternate Option Glazing Criteria (Similar Criteria Proposed for 2009 SEC)	5 and 4M	Curtainwall, Double Pane, 4 Sided Structural Silicon Glazing with Low E Coating	30%	40%	0.32 - 0.34	0.30	n/a	n/a		$ 92.00	$ 104.00	$ 100.40		11.9%	17.8%	Notes 1, 3, 5

Notes:

1. Based on current UA calculation experience glazing thermal performance is typically above the code default to compenstate for thermal bridging in opaque wall assemblies.
2. Default values for 0-30% WWR or Up to 40% when 50% Daylighting Criteria is met. For Daylighting option the glazing assembly VT must of equal or greater than the SHGC * 1.1.
3. Seattle Energy Code Optional Compliance Path with U-Value = 0.38 for first 30% glazing and U-Value = 0.22 for next 40% glazing.
   SEC Option results in a vertical wall and vertical glazing UA that is 10.6% less efficient that the 2012 WSEC for a 40%WWR Building.
4. Opaque wall assembly assumes a curtainwall assembly with insulated sprandrel panel with R-10 continuous insulation and a 3.5" metal stud wall with R-13 insulation.
5. Cost data was developed by Turner Construction Company working with Rushing and Vulcan, Inc. Turner averaged cost data from four glazing contractors to develop average assembly cost and type for each glazing option above.

2012 WSEC Analysis for Proposed 40% Glazing Path without Daylighting Option

	30% Building	40% Building	
building width	100	100	feet
building length	250	250	feet
building floor-to-floor	13	13	feet
exterior skin area	9100	9100	SF
glazing %	30%	40%	
glazing area <30%	2730	2730	SF
glazing area >30%		910	SF
opaque wall area	6370	5460	SF
metal glazing u-value <30%	0.38	0.299	required u-value for code compliance
metal glazing u-value >30%		0.299	required u-value for code compliance
opaque wall u-value	0.057	0.057	
overall vertical u-value	0.154	0.154	wall + glazing
vertical wall UA total	1400.5	1399.6	-0.9
% difference from target UA		-0.06%	if negative more stringent than code
metal glazing SHGC <30%	0.4	0.3	required SHGC for code compliance
metal glazing SHGC >30%		0.3	required SHGC for code compliance
SHGC * A Total	1092.0	1092.0	0.0
% difference from target SHGC*A		0.0%	if negative more stringent than code

2012 WSEC Analysis for Proposed 50% Glazing Path without Daylighting Option

	30% Building	50% Building	
building width	100	100	feet
building length	250	250	feet
building floor-to-floor	13	13	feet
exterior skin area	9100	9100	SF
glazing %	30%	50%	
glazing area <30%	2730	2730	SF
glazing area >30%		1820	SF
opaque wall area	6370	4550	SF
metal glazing u-value <30%	0.38	0.25	required u-value for code compliance
metal glazing u-value >30%		0.25	required u-value for code compliance
opaque wall u-value	0.057	0.057	
overall vertical u-value	0.154	0.154	wall + glazing
vertical wall UA total	1400.5	1396.9	
% difference from target UA		-0.3%	if negative more stringent than code
metal glazing SHGC <30%	0.4	0.24	required SHGC for code compliance
metal glazing SHGC >30%		0.24	required SHGC for code compliance
SHGC*A Total	1092.0	1092.0	0.0
% difference from target SHGC*A		0.0%	if negative more stringent than code

2012 WSEC Analysis for Proposed Optional 40% Glazing Path

	30% Building	40% Building with Optional Path	
building width	100	100	feet
building length	250	250	feet
building floor-to-floor	13	13	feet
exterior skin area	9100	9100	SF
glazing %	30%	40%	
glazing area <30%	2730	2730	SF
glazing area >30%		910	SF
opaque wall area	6370	5460	SF
metal glazing u-value <30%	0.38	0.38	required u-value for code compliance
metal glazing u-value >30%		0.22	required u-value for code compliance
opaque wall u-value	0.057	0.057	
overall vertical u-value	0.1539	0.1702	wall + glazing
vertical wall UA total	1400.5	1548.8	-148.3
% difference from target UA		10.6%	if negative more stringent than code
metal glazing SHGC <30%	0.4	0.3	
metal glazing SHGC >30%		0.3	
SHGC*A Total	1092.0	1092.0	0.0
% difference from target SHGC*A		0.0%	if negative more stringent than code
proposed code SHGC <40%		0.32	
% less stringent than code		6.7%	

2012 WSEC Analysis for Proposed Optional 40% Glazing Path

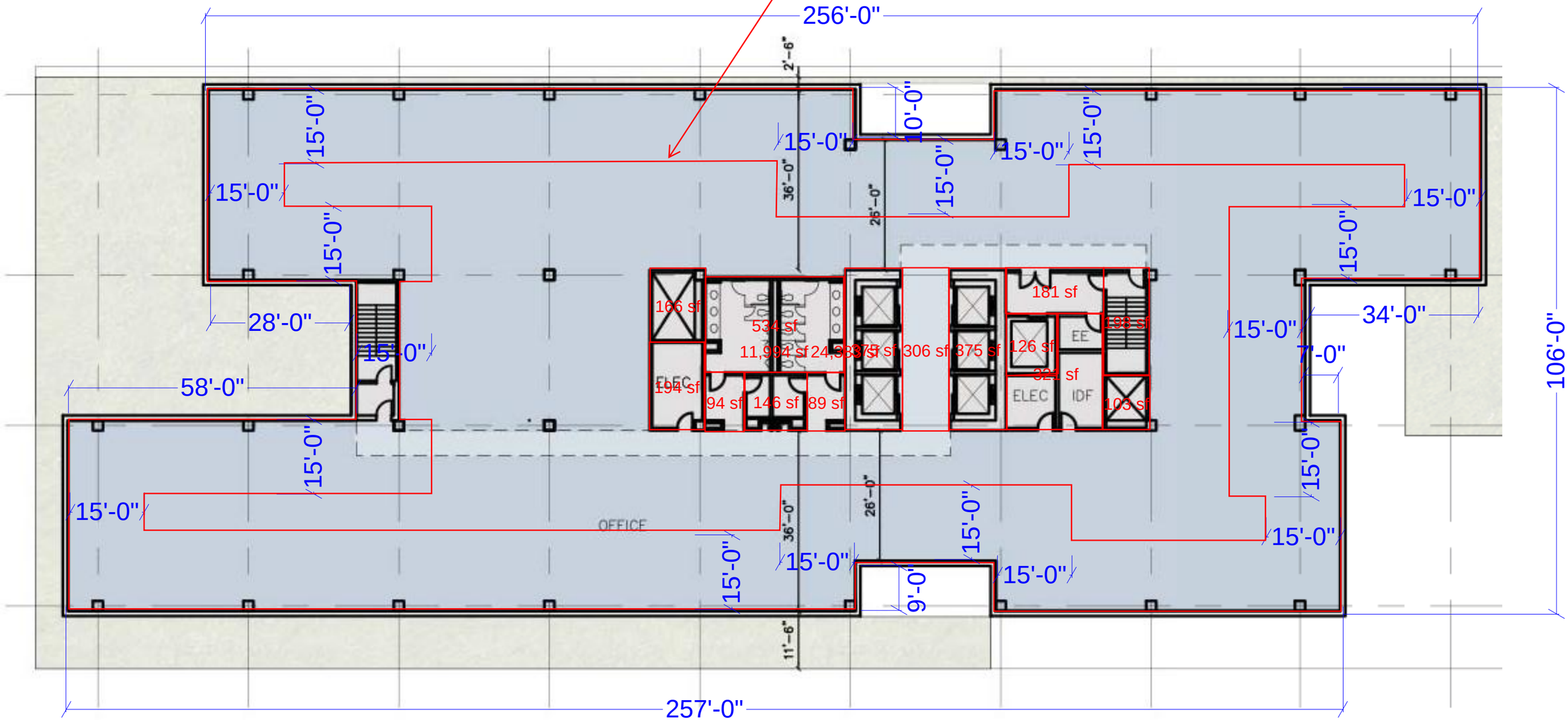
	30% Building	40% Building with Optional Path	
building width	100	100	feet
building length	250	250	feet
building floor-to-floor	13	13	feet
exterior skin area	9100	9100	SF
glazing %	30%	40%	
glazing area <30%	2730	2730	SF
glazing area >30%		910	SF
opaque wall area	6370	5460	SF
metal glazing u-value <30%	0.38	0.34	required u-value for code compliance
metal glazing u-value >30%		0.34	required u-value for code compliance
opaque wall u-value	0.057	0.057	
overall vertical u-value	0.154	0.170	wall + glazing
vertical wall UA total	1400.5	1548.8	
% difference from target UA		10.6%	if negative more stringent than code
metal glazing SHGC <30%	0.4	0.3	required SHGC for code compliance
metal glazing SHGC >30%		0.3	required SHGC for code compliance
SHGC*A Total	1092.0	1092.0	0.0
% difference from target SHGC*A		0.0%	if negative more stringent than code
proposed code SHGC <40%		0.32	
% less stringent than code		6.7%	

Office Building 1: Typical Floorplan Data

building floorplate overall area	24383	SF
elevator hoistway shaft area	876	SF
shaft area	269	SF
building gross conditioned floor area	**23238**	**SF**
Code Proposal Alternate to Adjust Floor Area for Spaces not Typically Daylight in Building Core		
elevator lobby area	670	SF
corridor area	0	SF
toilet room area	534	SF
stairwell area	198	SF
electrical/mechanical/janitor/storage room area	515	SF
building adjusted gross conditioned floor area	**21321**	**SF**
2012 IECC Daylight Zone Depth	15	feet
2012 IECC Daylight Zone Area	12389	SF
2012 IECC Daylight Zone Floor Area Ratio	**53.3%**	**based on gross cond floor area**
2012 IECC Daylight Zone Floor Area Ratio - Adjusted	**58.1%**	**based on adj. gross cond floor area**
2012 WSEC Daylight Zone Depth (2x glazing height)	18	feet
2012 WSEC Daylight Zone Area	14715	SF
2012 WSEC Daylight Zone Floor Area Ratio	60.3%	based on building floorplate overall area
2012 WSEC Daylight Zone Floor Area Ratio	**63.3%**	**based on gross cond floor area**
2012 WSEC Daylight Zone Floor Area Ratio - Adjusted	**69.0%**	**based on adj. gross cond floor area**
building floor-to-floor height	13	feet
building perimeter length	890	LF
height of glazing if continous band at 40% WWR	5.2	feet
top of glazing elevation	9	feet
corresponding bottom of glazing sill elevation	3.8	feet
vertical glazing WWR %	40%	
vertical glazing area	4628	SF
opaque wall area	6942	SF
top of glazing elevation	9	feet
typical bottom of glazing sill elevation	2.7	feet
glazing height	6.3	feet
total linear feet of glazing at 40% WWR	731	feet
percentage of floor perimeter LF with glazing	82.1%	
quantity of exterior columns/corners for opaque section	34	assumes floor to floor opaque section
LF of floor to floor opaque wall at columns/corners	4.7	< 4' no add'l flr-to-flr opaque area req'd

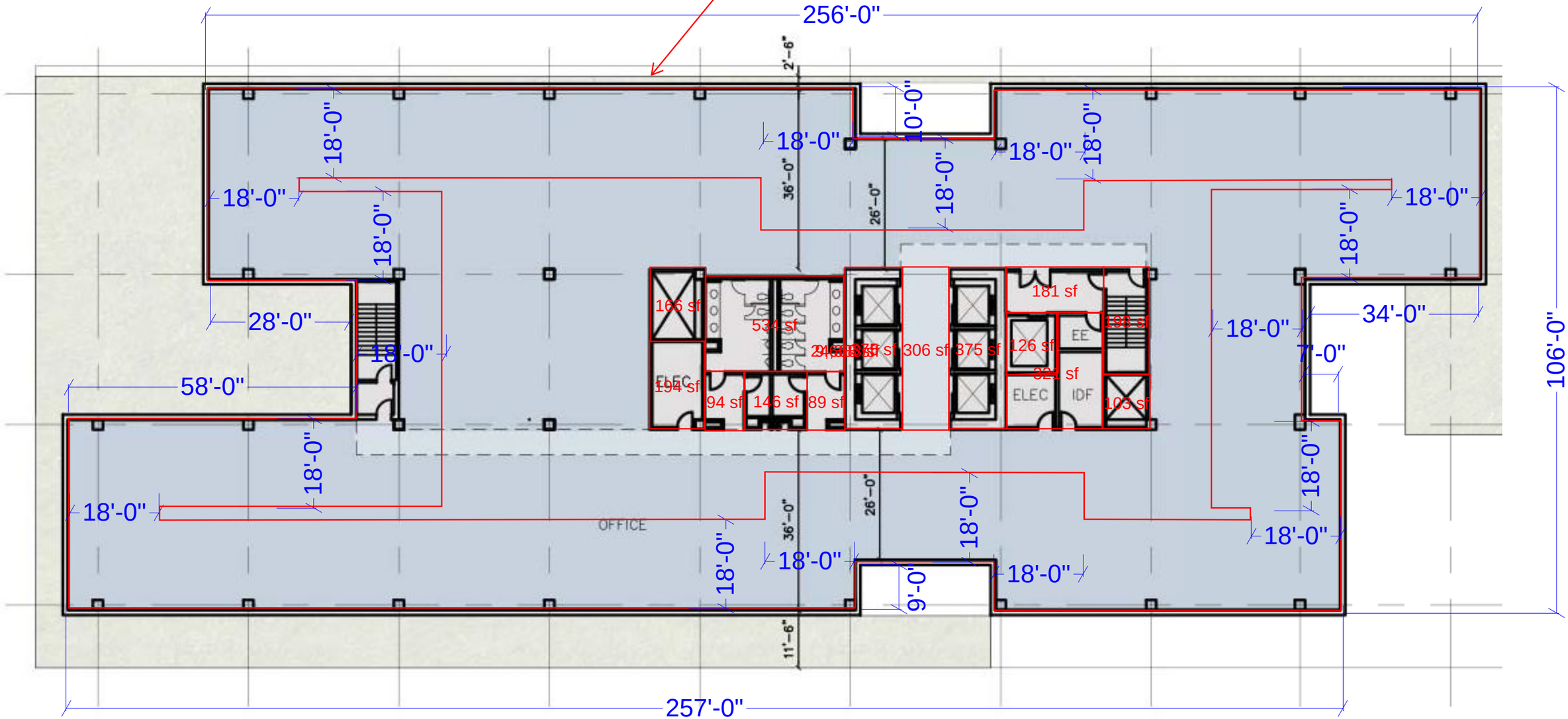
OFFICE BUILDING 1
DAYLIGHTING ANALYSIS
2012 IECC COMPLIANCE REVIEW
13'-0" FLOOR TO FLOOR

DAYLIGHT ZONE LINE
ALL AREA OUTSIDE OF LINE IS IN THE DAYLIGHT ZONE
ASSUMES THAT NO SECTION OF THE EXTERIOR PERIMETER LF IS TOTALLY OPAQUE WALL FOR MORE THAN 4 LF.



OFFICE BUILDING 1
DAYLIGHTING ANALYSIS
2012 WSEC COMPLIANCE REVIEW
13'-0" FLOOR TO FLOOR

DAYLIGHT ZONE LINE
ALL AREA OUTSIDE OF LINE IS IN THE DAYLIGHT ZONE
ASSUMES THAT NO SECTION OF THE EXTERIOR PERIMETER LF IS TOTALLY OPAQUE WALL FOR MORE THAN 4 LF.
ASSUME 9 FOOT HIGH TOP OF GLAZING ELEVATION.

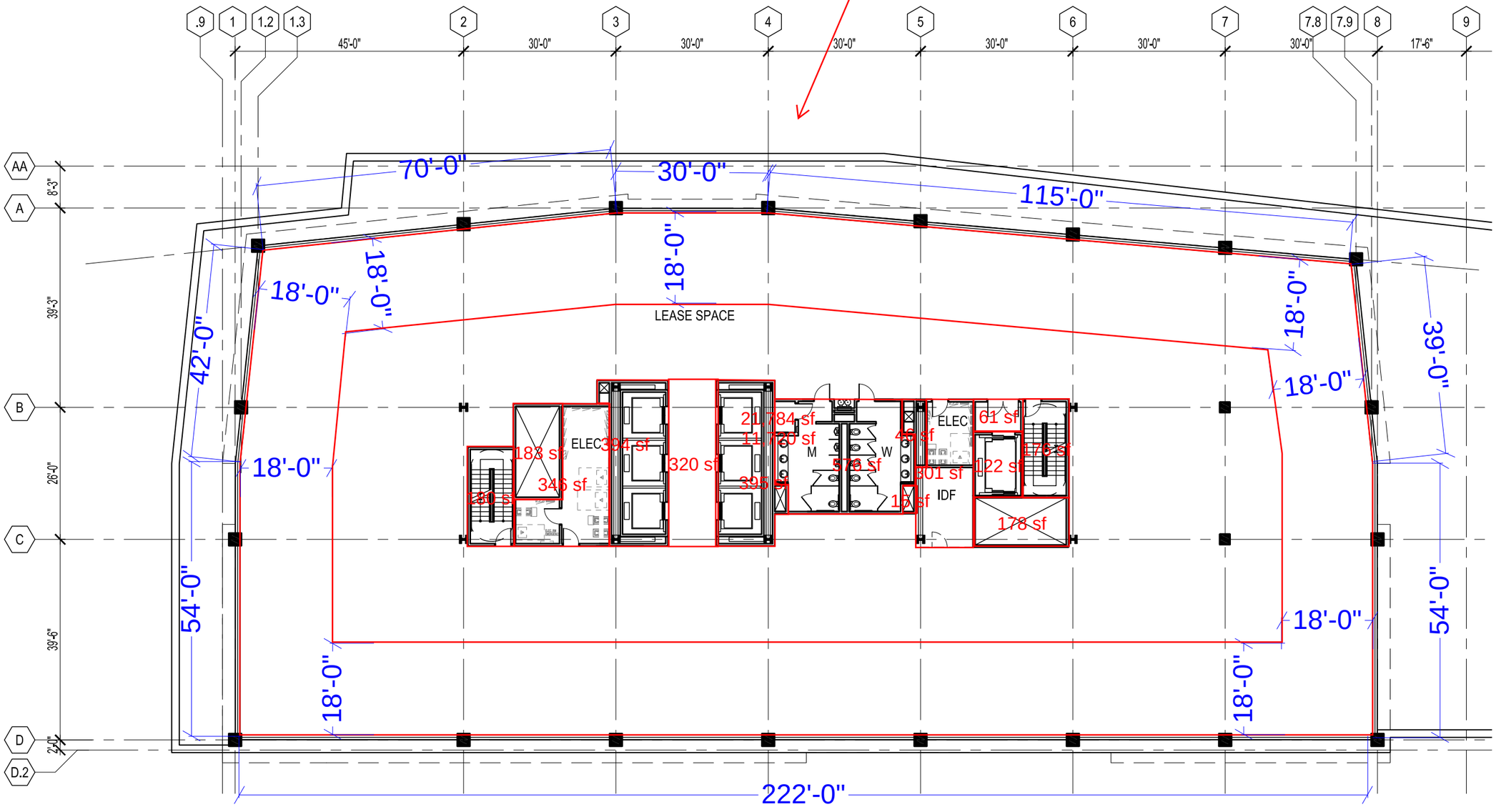


Office Building 2: Typical Floorplan Data

building floorplate overall area	21784	SF
elevator hoistway shaft area	911	SF
shaft area	422	SF
building gross conditioned floor area	**20451**	**SF**
Code Proposal Alternate to Adjust Floor Area for Spaces not Typically Daylight in Building Core		
elevator lobby area	381	SF
corridor area	0	SF
toilet room area	576	SF
stairwell area	356	SF
electrical/mechanical/janitor/storage room area	647	SF
building adjusted gross conditioned floor area	**18491**	**SF**
2012 WSEC Daylight Zone Depth (2x glazing height)	18	feet
2012 WSEC Daylight Zone Area	10064	SF
2012 WSEC Daylight Zone Floor Area Ratio	46.2%	based on building floorplate overall area
2012 WSEC Daylight Zone Floor Area Ratio	**49.2%**	**based on gross cond floor area**
2012 WSEC Daylight Zone Floor Area Ratio - Adjusted	**54.4%**	**based on adj. gross cond floor area**
building floor-to-floor height	13	feet
building perimeter length	626	LF
height of glazing if continous band at 40% WWR	5.2	feet
top of glazing elevation	9	feet
corresponding bottom of glazing sill elevation	3.8	feet
vertical glazing WWR %	40%	
vertical glazing area	3255.2	SF
opaque wall area	4882.8	SF
top of glazing elevation	9	feet
typical bottom of glazing sill elevation	2.7	feet
glazing height	6.3	feet
total linear feet of glazing at 40% WWR	514	feet
percentage of floor perimeter LF with glazing	82.1%	
quantity of exterior columns/corners for opaque section	24	assumes floor to floor opaque section
LF of floor to floor opaque wall at columns/corners	4.7	< 4' no add'l flr-to-flr opaque area req'd

OFFICE BUILDING 2
DAYLIGHTING ANALYSIS
2012 WSEC COMPLIANCE REVIEW
13'-0" FLOOR TO FLOOR

DAYLIGHT ZONE LINE
ALL AREA OUTSIDE OF LINE IS IN THE DAYLIGHT ZONE
ASSUMES THAT NO SECTION OF THE EXTERIOR PERIMETER LF IS TOTALLY OPAQUE WALL FOR MORE THAN 4 LF.
ASSUME 9 FOOT HIGH TOP OF GLAZING ELEVATION.

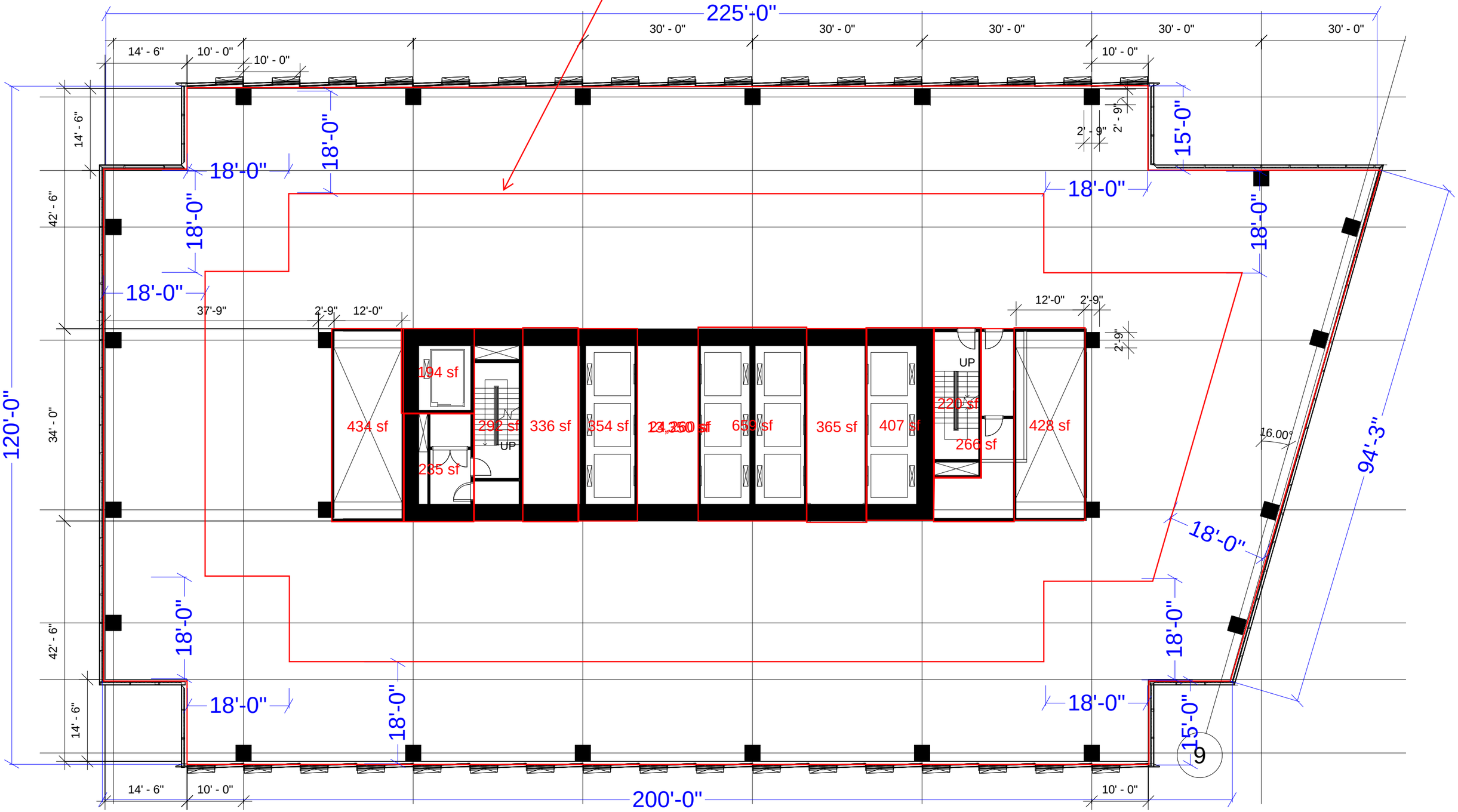


Office Building 3: Typical Floorplan Data

building floorplate overall area	24260	SF
elevator hoistway shaft area	1614	SF
shaft area	862	SF
building gross conditioned floor area	**21784**	**SF**
Code Proposal Alternate to Adjust Floor Area for Spaces not Typically Daylight in Building Core		
elevator lobby area	701	SF
corridor area	0	SF
toilet room area	336	SF
stairwell area	512	SF
electrical/mechanical/janitor/storage room area	501	SF
building adjusted gross conditioned floor area	**19734**	**SF**
2012 WSEC Daylight Zone Depth (2x glazing height)	18	feet
2012 WSEC Daylight Zone Area	10910	SF
2012 WSEC Daylight Zone Floor Area Ratio	45.0%	based on building floorplate overall area
2012 WSEC Daylight Zone Floor Area Ratio	**50.1%**	**based on gross cond floor area**
2012 WSEC Daylight Zone Floor Area Ratio - Adjusted	**55.3%**	**based on adj. gross cond floor area**
building floor-to-floor height	13.3	feet
building perimeter length	669	LF
height of glazing if continous band at 40% WWR	5.3	feet
top of glazing elevation	9	feet
corresponding bottom of glazing sill elevation	3.7	feet
vertical glazing WWR %	40%	
vertical glazing area	3568	SF
opaque wall area	5352	SF
top of glazing elevation	9	feet
typical bottom of glazing sill elevation	2.7	feet
glazing height	6.3	feet
total linear feet of glazing at 40% WWR	563	feet
percentage of floor perimeter LF with glazing	84.2%	
quantity of exterior columns/corners for opaque section	25	assumes floor to floor opaque section
LF of floor to floor opaque wall at columns/corners	4.2	< 4' no add'l flr-to-flr opaque area req'd

OFFICE BUILDING 3
DAYLIGHTING ANALYSIS
2012 WSEC COMPLIANCE REVIEW
13'-0" FLOOR TO FLOOR

DAYLIGHT ZONE LINE
ALL AREA OUTSIDE OF LINE IS IN THE DAYLIGHT ZONE
ASSUMES THAT NO SECTION OF THE EXTERIOR PERIMETER LF IS TOTALLY OPAQUE WALL FOR MORE THAN 4 LF.
ASSUME 9 FOOT HIGH TOP OF GLAZING ELEVATION.

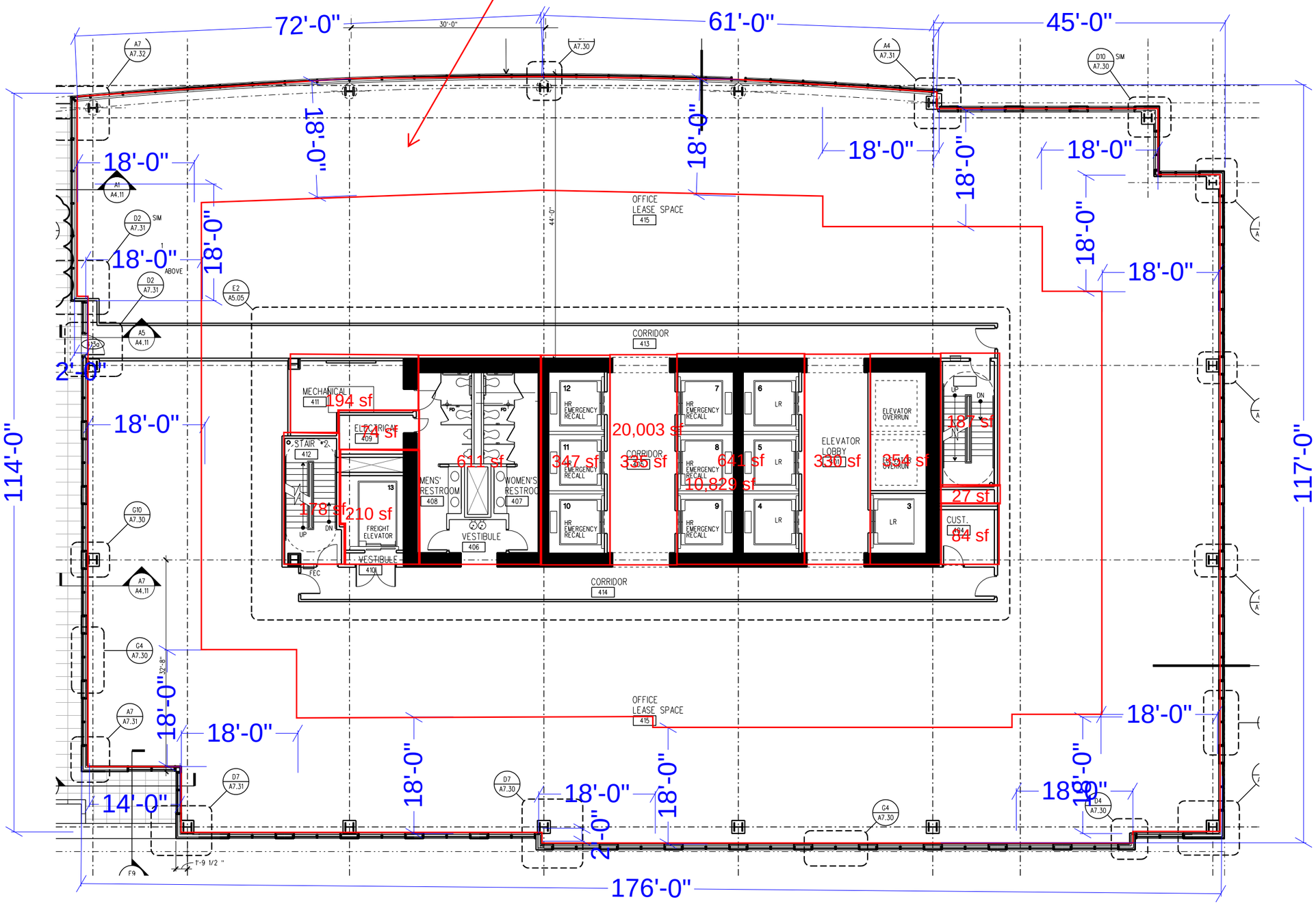


Office Building 4: Typical Floorplan Data

building floorplate overall area	20003	SF
elevator hoistway shaft area	1552	SF
shaft area	27	SF
building gross conditioned floor area	**18424**	**SF**
Code Proposal Alternate to Adjust Floor Area for Spaces not Typically Daylight in Building Core		
elevator lobby area	665	SF
corridor area	0	SF
toilet room area	611	SF
stairwell area	365	SF
electrical/mechanical/janitor/storage room area	352	SF
building adjusted gross conditioned floor area	**16431**	**SF**
2012 WSEC Daylight Zone Depth (2x glazing height)	18	feet
2012 WSEC Daylight Zone Area	9174	SF
2012 WSEC Daylight Zone Floor Area Ratio	45.9%	based on building floorplate overall area
2012 WSEC Daylight Zone Floor Area Ratio	**49.8%**	**based on gross cond floor area**
2012 WSEC Daylight Zone Floor Area Ratio - Adjusted	**55.8%**	**based on adj. gross cond floor area**
building floor-to-floor height	13.0	feet
building perimeter length	603	LF
height of glazing if continous band at 40% WWR	5.2	feet
top of glazing elevation	9	feet
corresponding bottom of glazing sill elevation	3.8	feet
vertical glazing WWR %	40%	
vertical glazing area	3135.6	SF
opaque wall area	4703.4	SF
top of glazing elevation	9	feet
typical bottom of glazing sill elevation	2.7	feet
glazing height	6.3	feet
total linear feet of glazing at 40% WWR	495	feet
percentage of floor perimeter LF with glazing	82.1%	
quantity of exterior columns/corners for opaque section	22	assumes floor to floor opaque section
LF of floor to floor opaque wall at columns/corners	4.9	if less than 4' no impact on daylight zone

OFFICE BUILDING 4
DAYLIGHTING ANALYSIS
2012 WSEC COMPLIANCE REVIEW
13'-0" FLOOR TO FLOOR

DAYLIGHT ZONE LINE
ALL AREA OUTSIDE OF LINE IS IN THE DAYLIGHT ZONE
ASSUMES THAT NO SECTION OF THE EXTERIOR PERIMETER LF IS TOTALLY OPAQUE WALL FOR MORE THAN 4 LF.
ASSUME 9 FOOT HIGH TOP OF GLAZING ELEVATION.

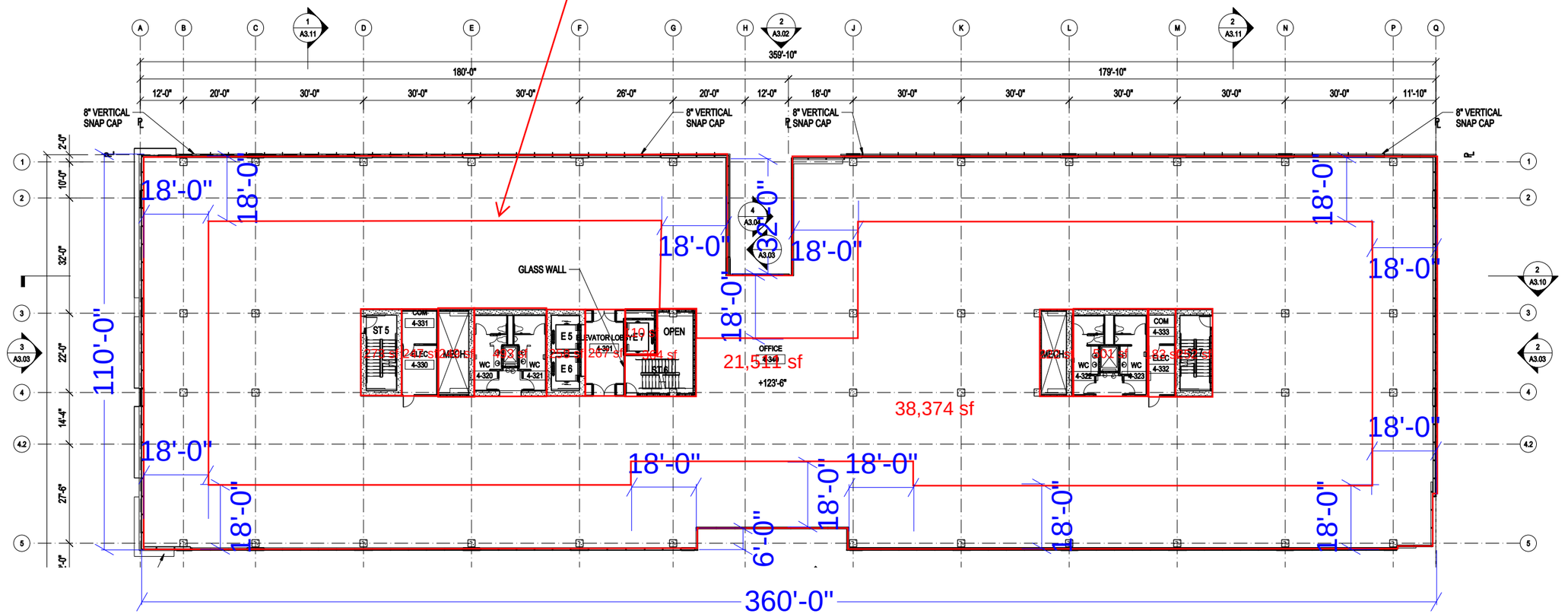


Office Building 5: Typical Floorplan Data

building floorplate overall area	38374	SF
elevator hoistway shaft area	368	SF
shaft area	471	SF
building gross conditioned floor area	**37535**	**SF**
Code Proposal Alternate to Adjust Floor Area for Spaces not Typically Daylight in Building Core		
elevator lobby area	267	SF
corridor area	0	SF
toilet room area	994	SF
stairwell area	889	SF
electrical/mechanical/janitor/storage room area	430	SF
building adjusted gross conditioned floor area	**34955**	**SF**
2012 WSEC Daylight Zone Depth (2x glazing height)	18	feet
2012 WSEC Daylight Zone Area	16863	SF
2012 WSEC Daylight Zone Floor Area Ratio	43.9%	based on building floorplate overall area
2012 WSEC Daylight Zone Floor Area Ratio	**44.9%**	**based on gross cond floor area**
2012 WSEC Daylight Zone Floor Area Ratio - Adjusted	**48.2%**	**based on adj. gross cond floor area**
building floor-to-floor height	12.5	feet
building perimeter length	1016	LF
height of glazing if continous band at 40% WWR	5.0	feet
top of glazing elevation	9	feet
corresponding bottom of glazing sill elevation	4.0	feet
vertical glazing WWR %	40%	
vertical glazing area	5080	SF
opaque wall area	7620	SF
top of glazing elevation	9	feet
typical bottom of glazing sill elevation	2.7	feet
glazing height	6.3	feet
total linear feet of glazing at 40% WWR	802	feet
percentage of floor perimeter LF with glazing	78.9%	
quantity of exterior columns/corners for opaque section	40	assumes floor to floor opaque section
LF of floor to floor opaque wall at columns/corners	5.3	< 4' no add'l flr-to-flr opaque area req'd

OFFICE BUILDING 5
DAYLIGHTING ANALYSIS
2012 WSEC COMPLIANCE REVIEW
13'-0" FLOOR TO FLOOR

DAYLIGHT ZONE LINE
ALL AREA OUTSIDE OF LINE IS IN THE DAYLIGHT ZONE
ASSUMES THAT NO SECTION OF THE EXTERIOR PERIMETER LF IS TOTALLY OPAQUE WALL FOR MORE THAN 4 LF.
ASSUME 9 FOOT HIGH TOP OF GLAZING ELEVATION.

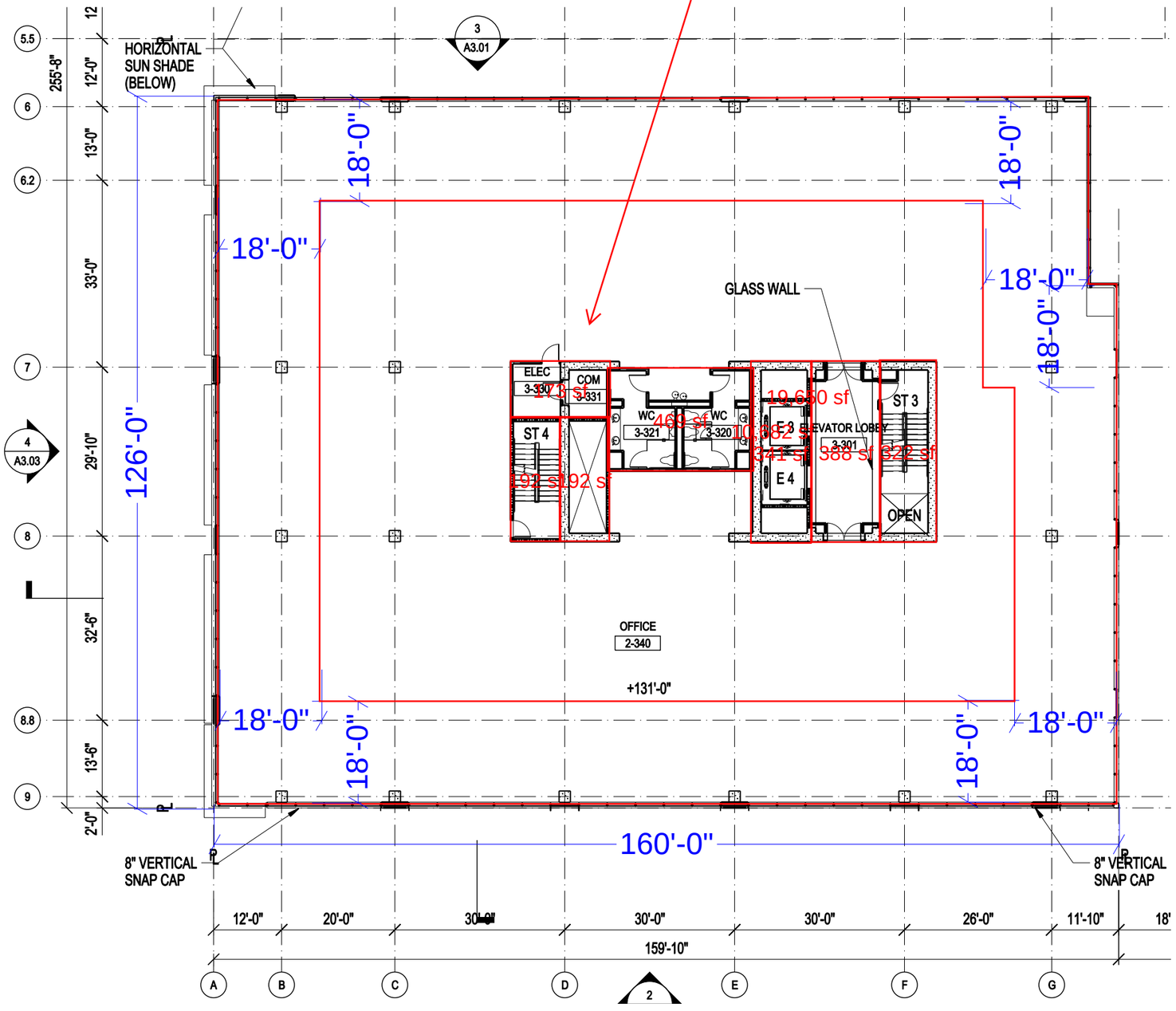


Office Building 6: Typical Floorplan Data

building floorplate overall area	19650	SF
elevator hoistway shaft area	341	SF
shaft area	192	SF
building gross conditioned floor area	**19117**	**SF**
Code Proposal Alternate to Adjust Floor Area for Spaces not Typically Daylight in Building Core		
elevator lobby area	514	SF
corridor area	0	SF
toilet room area	469	SF
stairwell area	514	SF
electrical/mechanical/janitor/storage room area	173	SF
building adjusted gross conditioned floor area	**17447**	**SF**
2012 WSEC Daylight Zone Depth (2x glazing height)	18	feet
2012 WSEC Daylight Zone Area	8968	SF
2012 WSEC Daylight Zone Floor Area Ratio	45.6%	based on building floorplate overall area
2012 WSEC Daylight Zone Floor Area Ratio	**46.9%**	**based on gross cond floor area**
2012 WSEC Daylight Zone Floor Area Ratio - Adjusted	**51.4%**	**based on adj. gross cond floor area**
building floor-to-floor height	12.5	feet
building perimeter length	572	LF
height of glazing if continous band at 40% WWR	5.0	feet
top of glazing elevation	9	feet
corresponding bottom of glazing sill elevation	4.0	feet
vertical glazing WWR %	40%	
vertical glazing area	2860	SF
opaque wall area	4290	SF
top of glazing elevation	9	feet
typical bottom of glazing sill elevation	2.7	feet
glazing height	6.3	feet
total linear feet of glazing at 40% WWR	452	feet
percentage of floor perimeter LF with glazing	78.9%	
quantity of exterior columns/corners for opaque section	23	assumes floor to floor opaque section
LF of floor to floor opaque wall at columns/corners	5.2	< 4' no add'l flr-to-flr opaque area req'd

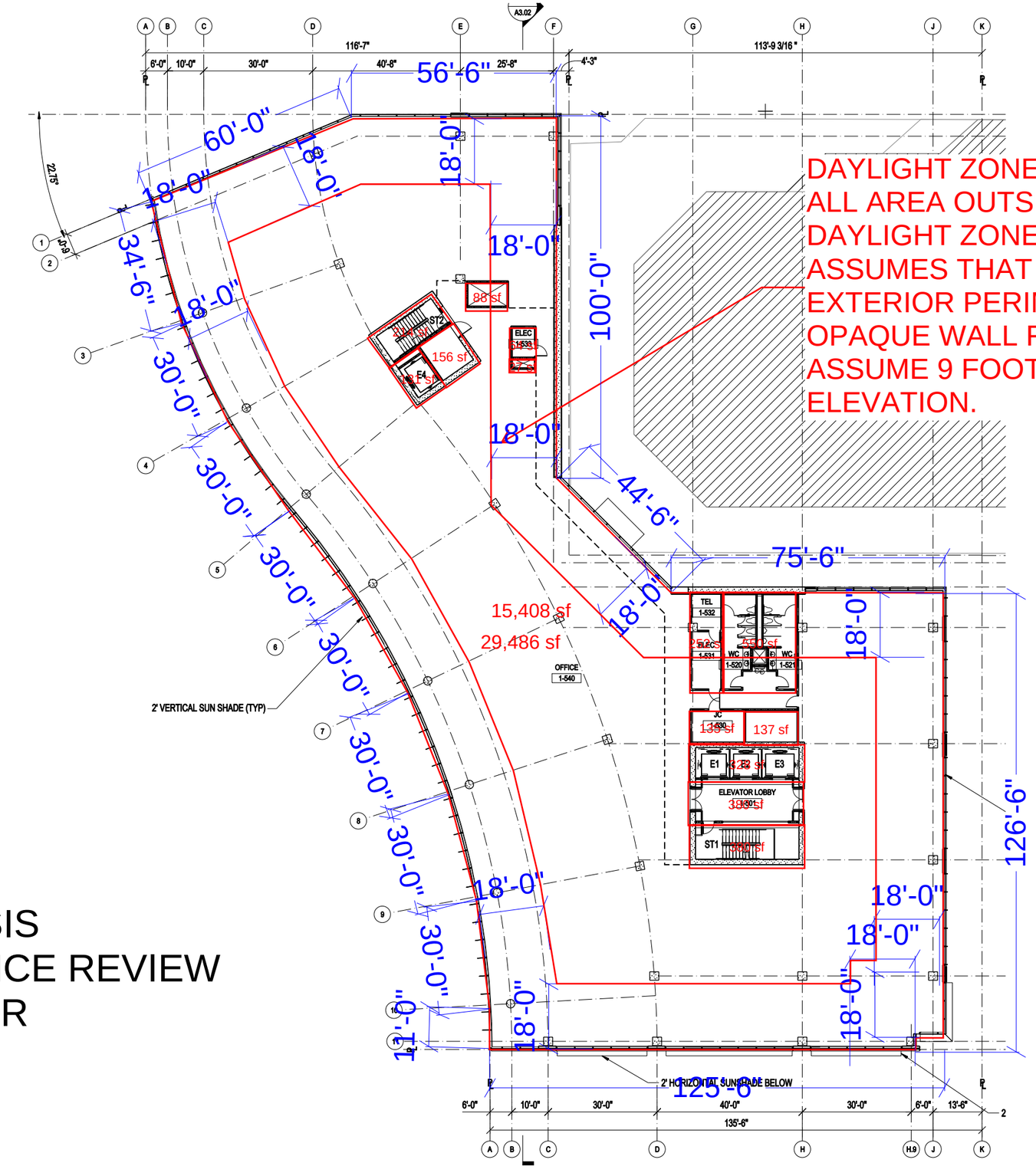
OFFICE BUILDING 6
DAYLIGHTING ANALYSIS
2012 WSEC COMPLIANCE REVIEW
12'-6" FLOOR TO FLOOR

DAYLIGHT ZONE LINE
ALL AREA OUTSIDE OF LINE IS IN THE DAYLIGHT ZONE
ASSUMES THAT NO SECTION OF THE EXTERIOR PERIMETER LF IS TOTALLY OPAQUE WALL FOR MORE THAN 4 LF.
ASSUME 9 FOOT HIGH TOP OF GLAZING ELEVATION.



Office Building 7: Typical Floorplan Data

building floorplate overall area	29486	SF
elevator hoistway shaft area	459	SF
shaft area	252	SF
building gross conditioned floor area	**28775**	**SF**
Code Proposal Alternate to Adjust Floor Area for Spaces not Typically Daylight in Building Core		
elevator lobby area	536	SF
corridor area	0	SF
toilet room area	550	SF
stairwell area	594	SF
electrical/mechanical/janitor/storage room area	451	SF
building adjusted gross conditioned floor area	**26644**	**SF**
2012 WSEC Daylight Zone Depth (2x glazing height)	18	feet
2012 WSEC Daylight Zone Area	14077	SF
2012 WSEC Daylight Zone Floor Area Ratio	47.7%	based on building floorplate overall area
2012 WSEC Daylight Zone Floor Area Ratio	**48.9%**	**based on gross cond floor area**
2012 WSEC Daylight Zone Floor Area Ratio - Adjusted	**52.8%**	**based on adj. gross cond floor area**
building floor-to-floor height	12.5	feet
building perimeter length	844	LF
height of glazing if continous band at 40% WWR	5.0	feet
top of glazing elevation	9	feet
corresponding bottom of glazing sill elevation	4.0	feet
vertical glazing WWR %	40%	
vertical glazing area	4220	SF
opaque wall area	6330	SF
top of glazing elevation	9	feet
typical bottom of glazing sill elevation	2.7	feet
glazing height	6.3	feet
total linear feet of glazing at 40% WWR	666	feet
percentage of floor perimeter LF with glazing	78.9%	
quantity of exterior columns/corners for opaque section	25	assumes floor to floor opaque section
LF of floor to floor opaque wall at columns/corners	7.1	< 4' no add'l flr-to-flr opaque area req'd



OFFICE BUILDING 7
DAYLIGHTING ANALYSIS
2012 WSEC COMPLIANCE REVIEW
12'-6" FLOOR TO FLOOR

MEMO

TO: Washington State Building Code Council

DATE: March 1, 2013

SUBJECT: 2012 WSEC Vertical Glazing Percentage Background Information

FROM: Eric Vander Mey, PE (206-285-7114, ericv@rushingco.com)

Rushing has been reviewing and proposing changes to the 2012 WSEC in regard to the maximum glazing percentage. Below is a quick recap of the major impacts. The subsequent pages provide additional documentation on the code changes and history of the changes.

Bullet Point Recap:

- IECC
  - 2012 IECC utilizes 30% WWR for prescriptive compliance
  - 2012 IECC utilizes 40% WWR for TBP compliance
  - Optional daylighting compliance path to get to 40% WWR if 50% of the conditioned floor area is in the daylight zone
    - Most projects will have a hard time getting 50% of the conditioned floor area in the daylight zone per the 2012 IECC definitions of conditioned space and daylight zone.
    - Exception would not apply to the typical residential buildings as there are typically not lighting fixtures with daylighting controls. It is unclear per the 2012 IECC if residential occupancies can utilize this exception without permanent lighting fixtures in the daylight zone.
- WSEC
  - 2012 WSEC added Target UA Compliance
  - 2012 WSEC Modified definition of the daylight zone
  - 2012 WSEC corrected TBP compliance to utilize 40% WWR to match prescriptive and Target UA
- SEC
  - Same compliance paths as the 2012 WSEC.
  - Proposed added an exception that would allow the glazing area that is more that 30% and less that 40% to have a default u-value of 0.22. This would apply to prescriptive, target UA, and TBP compliance paths.
  - This would allow the UA of the vertical wall to be increased to approximately 10% above the default code value.
  - This would allow the u-value for up to 40% of the metal glazing to have an overall area weighted u-value of 0.34 instead of 0.30.
  - Therefore, if all the vertical glazing (up to 40% WWR) were really good double pane thermally broken glazing then it may be possible to comply using target UA without going to triple pane glazing for a portion of the building. This would require the walls to be insulated very well without thermal breaks at slab edges.
  - Glazing would still have to meet the SHGC requirement unless Seattle modifies its proposal.

2012 IECC (without Washington Amendments):

- Envelope Compliance Options:
  - Prescriptive
  - No Target UA
  - Total Building Performance (TBP) Energy Modeling
- Section C402.3
  - 30% Maximum Vertical Glazing
  - Exception for 40% Maximum Vertical Glazing when daylighting requirements are met for 50% of floor area in daylight zone
- Total Building Performance (TBP) Energy Modeling Compliance Path
  - Table C407.5.1.1(1) Baseline Code Building
    - 40% Maximum Vertical Glazing is listed
  - Section C401.2 Option 3 TBP Energy Modeling Option:
    - Proposed building is 15% more efficient that code baseline building

2012 WSEC

- Envelope Compliance Options:
  - Prescriptive
  - Target UA Added by Washington State based on Rushing Proposal
  - Total Building Performance (TBP) Energy Modeling
- Section C402.3
  - 30% Maximum Vertical Glazing
  - Exception for 40% Maximum Vertical Glazing when daylighting requirements are met for 50% of floor area in daylight zone. Washington State modified the definition of the daylight zone to be twice the height of the glazing. This provides some additional flexibility.
  - Same as 2012 IECC with minor changes in terms used
- Total Building Performance (TBP) Energy Modeling Compliance Path
  - Table C407.5.1.1(1) Baseline Code Building
    - Code Change Proposal E119 (proposed by John Hogan) corrected the maximum glazing percentage from 40% to 30%
    - Table was amended by the TAG so Code Baseline building has a 30% Maximum Vertical Glazing
    - This is published in the August public review draft
  - Section C401.2 Option 3 TBP Energy Modeling Option:
    - Proposed building is 7% more efficient that code baseline building
      - This was modified by the WSBCC in the last meeting from 10% to 7% based on the elimination of Section 406 (high efficiency option section)
      - Energy Code TAG modified from 15% to 10% based on the 2012 WSEC being more efficient that the IECC
      - Rushing tried to argue for 5% more efficient during the TAG process but the TAG settled on 10%

2012 SEC

- Envelope Compliance Options:
  - Prescriptive
  - Target UA Added by Washington State is Maintained
  - Total Building Performance (TBP) Energy Modeling
  - Added optional EUI target performance compliance path
- Section C402.3
  - 30% Maximum Vertical Glazing
  - Exception for 40% Maximum Vertical Glazing when daylighting requirements are met for 50% of floor area in daylight zone.
  - Has a proposed alternate up to 40% WWR Compliance Path with slightly less stringent u-value for last 10% WWR glazing of 0.22. Per latest draft there is no requirement for the glazing VT to SHGC ratio. There is also no correction to the maximum SHGC for the glazing. Alternate path would apply to prescriptive, target UA, and TBP compliance paths.
- Total Building Performance (TBP) Energy Modeling Compliance Path
  - Table C407.5.1.1(1) Baseline Code Building
    - Same as WSEC that corrected the maximum glazing percentage from 40% to 30%
  - Section C401.2 Option 3 TBP Energy Modeling Option:
    - Proposed building is 7% more efficient that code baseline building same as Washington State

Background Information on IECC Change to 30% WWR Glazing Area:

- NBI & AIA propose the change from 40% to 30% glazing in EC165 (see excerpt below).
- ASHRAE 90.1-2010 remains at 40% glazing.

History of Changes from 2009 IECC to 2012 IECC to 2012 WSEC to 2012 SEC:

2009 IECC:

502.3 Fenestration (Prescriptive). Fenestration shall comply with Table 502.3.

502.3.1 Maximum area. The vertical fenestration area (not including opaque doors) shall not exceed the percentage of the gross wall area specified in Table 502.3. The skylight area shall not exceed the percentage of the gross roof area specified in Table 502.3.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC-all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and nonentrance doors.

2009 IECC Code Change Proposal for 2012 IECC:

Many proposals for 2009 IECC Table 502.3 but this is the only one that Rushing located that recommend changing the vertical glazing percentage:

EC165–09/10

Table 502.3

Proponent: David C. Hewitt, New Buildings Institute, John Loyer, American Institute of Architects

Revise as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4, except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (~~40~~30% maximum of above-grade wall)								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor[a]	1.20/ 0.57	~~0.75~~ 0.57	~~0.65~~ 0.40	~~0.40~~ 0.35	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor[a]	1.0/ 0.57	~~0.70~~ 0.57	~~0.60~~ 0.50	~~0.50~~ 0.42	~~0.45~~ 0.42	~~0.45~~ 0.42	0.40	0.40
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other *U*-Factor[a,b]	1.20/ 0.65	~~0.75~~ 0.65	~~0.65~~ 0.60	~~0.55~~ 0.50	~~0.55~~ 0.50	~~0.55~~ 0.50	0.45	~~0.45~~ 0.40
SHGC- All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum, 5% maximum with automatic day lighting controls[c])								
U-Factor	0.75	~~0.75~~ 0.65	~~0.65~~ 0.55	~~0.60~~ 0.50	~~0.60~~ 0.50	~~0.60~~ 0.50	~~0.60~~ 0.50	~~0.60~~ 0.50
SHGC[d]	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. The first U-factor applies when impact rated glazing is installed.
b. "All others" includes operable windows, fixed windows, and ~~nonentrance~~ doors other than entrance doors.
c. Automatic day lighting controls shall meet the requirements of Section 505.2.2.3.3.
d. The SHGC for Climate Zones 1 – 6 can be increased to SHGC no greater than 0.60 if the Visible Transmittance (VT) is not less than 0.60 and automatic day lighting controls are installed that meet the requirements of Section 505.2.2.3.3.

Reason: This Building Envelope proposal provides the fenestration tables to complement the comprehensive proposal submitted on behalf of New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. This table provides significant improvements in glazing performance for the model code. The u-values and SHGC values include specifications from *Core Performance Guide*, 2009 IECC and proposed ASHRAE 90.1-2010.

Cost Impact: This code change proposal will increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: HEWITT-LOYER-EC1-T502.3

2009 IECC Code Change Proposal for 2012 IECC Final Action Results:

FINAL ACTION HEARING RESULTS

AM	=	Approved as Modified
AMPC	=	Approved as Modified by Public Comment
AS	=	Approved as Submitted
D	=	Disapproved
WP	=	Withdrawn by Proponent

IECC Chapter 5

EC147-09/10 AMPC1,3,4,5,6,10,20,30,37
EC148-09/10 ..... D
EC150-09/10 ..... D
EC157-09/10 ..... AMPC1
EC158-09/10 ..... WP
EC159-09/10 ..... AMPC2
EC164-09/10 ..... D
EC165-09/10 ..... AMPC1,5

2012 IECC Final Code Language:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

C402.3.1 Maximum area. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not exceed 30 percent of the gross above-grade wall area. The skylight area shall not exceed 3 percent of the gross roof area.

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;
2. Automatic daylighting controls are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

C402.3.1.2 Increased skylight area with daylighting controls. The skylight area shall be permitted to be a maximum of 5 percent of the roof area provided automatic daylighting controls are installed in daylight zones under skylights.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
***U*-factor**								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
***U*-factor**	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

DAYLIGHT ZONE.

1. **Under skylights.** The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor-to-ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.
2. **Adjacent to vertical fenestration.** The area adjacent to vertical fenestration which receives daylight through the fenestration. For purposes of this definition and unless more detailed analysis is provided, the daylight *zone* depth is assumed to extend into the space a distance of 15 feet (4572 mm) or to the nearest ceiling height opaque partition, whichever is less. The daylight *zone* width is assumed to be the width of the window plus 2 feet (610 mm) on each side, or the window width plus the distance to an opaque partition, or the window width plus one-half the distance to adjacent skylight or vertical fenestration, whichever is least.

2012 IECC Code Commentary:

C402.3.1 Maximum area. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not exceed 30 percent of the gross above-grade wall area. The skylight area shall not exceed 3 percent of the gross roof area.

❖ This section establishes that a maximum of 30 percent of the gross above-grade wall area of a building can be vertical fenestration and that a maximum of 3 percent of the gross roof area can be skylights. Because the thermal performance of fenestrations is lower than that required for the wall and roof under Section C402.2, the code limits the amount of wall and roof that may be removed to minimize the reduced efficiency. If a building design does not exceed these area limitations, the prescriptive provisions cannot be used, and the total-building-performance requirements of Section C407 or the ANSI/ASHRAE/IESNA 90.1 would be used to demonstrate compliance with the building envelope requirements (see Sections C401.2 and C402.1.1).

The gross area of exterior walls is the normal projection of all exterior walls, including the area of all windows and doors installed therein. The gross wall area is the area of the wall measured on the exterior face from the top of the lowest floor to the bottom of the roof. The gross wall area does not include semi-exterior walls or interior partitions. Generally, the gross wall area is based on the area of above-grade walls (see Section C402.2.2.1). Therefore, the above grade portion of below-grade walls (Section C402.2.2.2) and the area of fenestration in those portions typically are excluded when calculating the percentage of openings. Because of the lack of clarity in the code, some code officials may, however, decide to include the exposed (above-grade) portion of a below-grade wall when determining gross wall area and fenestration percentages.

When determining the gross wall area, it is important to remember that the area should include not only the exterior exposed walls, but also the areas of gable and dormer walls, band joists between floors, between-floor spandrels, peripheral edges of floors, roof and attic kneewalls, skylight shafts and any other wall that forms the boundary of conditioned spaces. The wall between an unconditioned garage and a conditioned interior space should not be overlooked in calculating the gross wall area.

It is also important to remember that opaque doors (doors having less than 50 percent glass area) are regulated by Section C402.2.7 and would not be included within the 30-percent limitation for fenestration.

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;
2. Automatic daylighting controls are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

   Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

❖ This section establishes that a maximum of 40 percent of the gross wall area of a building can be vertical fenestration and that a maximum of 3 percent of the gross roof area can be skylights. Because the thermal performance of fenestrations is lower than that required for the wall and roof under Section C402.2, the code limits the amount of wall and roof that may be removed to minimize the reduced efficiency. If a building design does exceed these area limitations, the prescriptive provisions cannot be used and the total building performance requirements of Section C407 or the ANSI/ASHRAE/IESNA 90.1 would be used to demonstrate compliance with the building envelope requirements (see Sections C401.2 and C402.1.1).

The gross area of exterior walls is the normal projection of all exterior walls, including the area of all windows and doors installed therein. The gross wall area is the area of the wall measured on the exterior face from the top of the lowest floor to the bottom of the roof. The gross wall area does not include semi-exterior walls or interior partitions. Generally, the gross wall area is based on the area of above-grade walls (see Section C402.2.2.1). Therefore, those portions typically are excluded when calculating the percentage of openings. Because of the lack of clarity in the code, some code officials may, however, decide to include the exposed (above grade) portion of a below-grade wall when determining gross wall area and fenestration percentages.

When determining the gross wall area, it is important to remember that the area should include not only the exterior exposed walls, but also the areas of gable and dormer walls, band joists between floors, between-floor spandrels, peripheral edges of floors, roof and attic kneewalls, skylight shafts and any other wall that forms the boundary of conditioned spaces. The wall between an unconditioned garage and a conditioned interior space should not be overlooked in calculating the gross wall area.

It is also important to remember that opaque doors (doors having less than 50 percent glass area) are regulated by Section C402.2.7 and would not be included within the 40-percent limitation for fenestration.

Table C402.3 provides both the *U*-factor and SHGC requirements for all types of fenestration and skylights. When using the table, it is important to select the correct framing material when determining the maximum *U*-factors.

ASHRAE 90.1-2010: Climate Zone 4C: Seattle

- ASHRAE 90.1-2010 remains at 40% glazing:

TABLE 5.5-4 Building Envelope Requirements for Climate Zone 4 (A, B, C)*

	Nonresidential		Residential		Semiheated	
Fenestration	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC
Vertical Glazing, 0%–40% of Wall						
Nonmetal framing (all)[c]	U-0.40	SHGC-0.40 all	U-0.40	SHGC-0.40 all	U-1.20	SHGC-NR all
Metal framing (curtainwall/storefront)[d]	U-0.50		U-0.50		U-1.20	
Metal framing (entrance door)[d]	U-0.85		U-0.85		U-1.20	
Metal framing (all other)[d]	U-0.55		U-0.55		U-1.20	

2012 WSEC (based on 2012 IECC):

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

C402.3.1 Maximum area. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not exceed 30 percent of the gross above-grade wall area. The skylight area shall not exceed 3 percent of the gross roof area.

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;
2. Automatic daylighting controls are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

C402.3.1.2 Increased skylight area with daylighting controls. The skylight area shall be permitted to be a maximum of 5 percent of the roof area provided automatic daylighting controls are installed in daylight zones under skylights.

2012 WSEC Definition of the Daylight Zone:

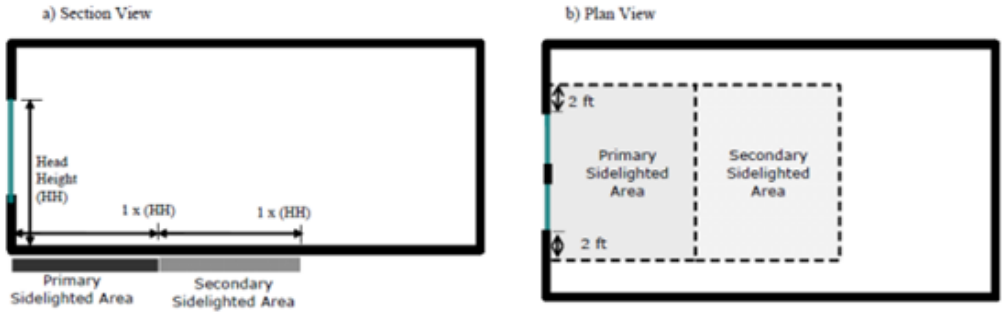
DAYLIGHT ZONE. (See also Fig. C202.1)

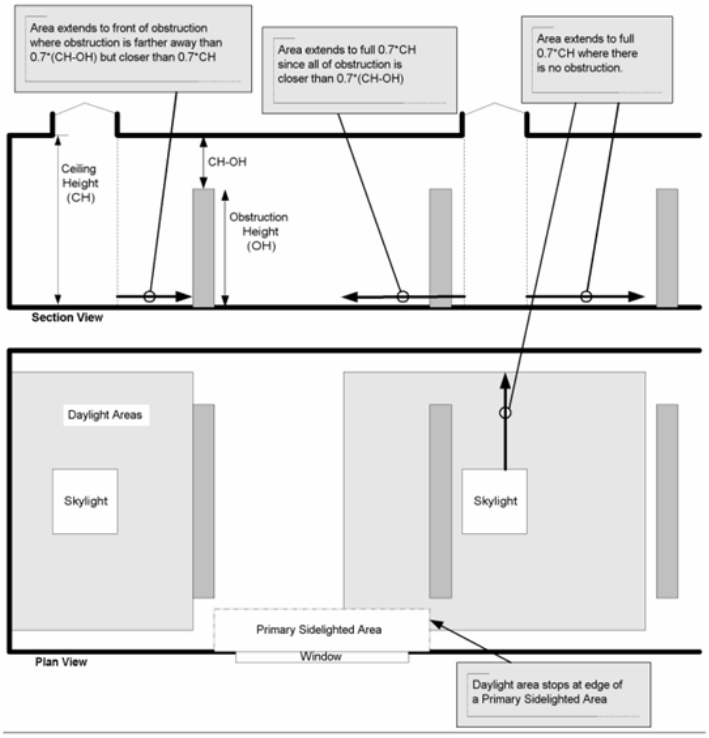
1. **Under skylights.** The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either 70 percent of the floor-to-ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.

2. **Adjacent to vertical fenestration.** The area adjacent to vertical fenestration which receives daylight through the fenestration. For purposes of this definition and unless more detailed analysis is provided, the primary daylight *zone* depth is assumed to extend into the space a distance ~~of 15 feet (4572 mm)~~ equal to the window head height and the secondary daylighted zone extends from the edge of the primary zone to a distance equal to two times the window head height or to the nearest ceiling height opaque partition, whichever is less. The daylight *zone* width is assumed to be the width of the window plus 2 feet (610 mm) on each side, or the window width plus the distance to an opaque partition, or the window width plus one-half the distance to adjacent skylight or vertical fenestration, whichever is least.

3. **In parking garages**: the area within 20 feet of any portion of a perimeter wall that has a net opening to wall ratio of at least 40% and no exterior obstructions within 20 feet.

FIGURE C202.1





2012 WSEC – Definitions

ABOVE-GRADE WALL. A wall ~~more than 50 percent above grade and~~ enclosing *conditioned space* that is not a below-grade wall. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.¶

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the *conditioned space*.¶

CONDITIONED SPACE. An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space*¶

2012 IECC – TBP Energy Modeling Path Information:

COMMERCIAL ENERGY EFFICIENCY

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN

Glazing	Area 1. The proposed glazing area; where the proposed glazing area is less than 40 percent of above-grade wall area. 2. 40 percent of above-grade wall area; where the proposed glazing area is 40 percent or more of the above-grade wall area. *U*-factor: from Table C402.3 SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used External shading and PF: None	As proposed As proposed As proposed As proposed
Skylights	Area 1. The proposed skylight area; where the proposed skylight area is less than 3 percent of gross area of roof assembly. 2. 3 percent of gross area of roof assembly; where the proposed skylight area is 3 percent or more of gross area of roof assembly *U*-factor: from Table C402.3 SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed As proposed As proposed

2012 WSEC Vertical Fenestration for TBP Energy Modeling Path:

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Vertical Fenestration	Area 1. The proposed vertical fenestration area; where the proposed vertical fenestration area is less than 30 percent of above-grade wall area. 2. 30 percent of above-grade wall area; where the proposed vertical fenestration area is 30 percent or more of the above-grade wall area. *U*-factor: from Table C402.3 for the same framing material as proposed SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used External shading and PF: None	As proposed As proposed As proposed As proposed
Skylights	Area 1. The proposed skylight area; where the proposed skylight area is less than 3 percent of gross area of roof assembly. 2. 3 percent of gross area of roof assembly; where the proposed skylight area is 3 percent or more of gross area of roof assembly U-factor: from Table C402.3 SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed As proposed As proposed

2012 Seattle Energy Code Proposed Section C402.3

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

Table C402.3

Building Envelope Requirements -- Fenestration

CLIMATE ZONE	5 AND MARINE 4	6
Vertical Fenestration		
***U*-factor**		
Nonmetal framing (all)[a]	0.30	0.30
Metal framing (fixed)[b]	0.38	0.36
Metal framing (operable)[c]	0.40	0.40
Metal framing (entrance doors)[d]	0.60	0.60
SHGC		
SHGC	~~0.40~~ 0.35	0.40
Skylights		
***U*-factor**	~~0.50~~ 0.45	0.50
SHGC	~~0.35~~ 0.32	0.35

2012 SEC Vertical Fenestration Proposed Amendment:

Proposed Amendment: Allow additional glazing area in the prescriptive path, up to 40% of the wall area, but require significantly better U-values for the additional fenestration.

	2009 Seattle Energy Code	2012 State Energy Code	2012 Seattle Energy Code Proposed
Prescriptive Glazing limit (vision glass % of above-grade wall area)	40% of wall area	30% of wall area	30% standard glazing + 10% high-performance glazing
Max U-value aluminum-framed fenestration (prescriptive path)	0.38	0.38	0.38 for 0 – 30% of wall **0.22** for the next 10% of wall Over 40% not allowed
Max U-value wood, vinyl or fiberglass-framed (prescriptive path)	0.30	0.30	0.30 for 0 – 30% of wall **0.22** for the next 10% of wall Over 40% not allowed

Modify Target UxA calculations and Total Building Performance path calculations as required to reflect this change. For buildings with large glazing areas, the reference case for the first 30% glazing area would use the prescriptive U-values in the table, while additional glazing area up to 40% would be calculated based on the more stringent U-value. These paths allow other higher-performing building components to be traded off against the more restrictive glazing requirement. The reference case for buildings with areas over 40% would be calculated based on the 40% maximum area.

2012 SEC Analysis for Proposed Optional 40% Glazing Path

	30% Building	40% Building with Optional Path	
building width	95	95	feet
building length	250	250	feet
building floor-to-floor	13	13	feet
exterior skin area	8970	8970	SF
glazing %	30%	40%	
glazing area <30%	2691	2691	SF
glazing area >30%	0	897	SF
opaque wall area	6279	5382	SF
metal glazing u-value <30%	0.38	0.38	
metal glazing u-value >30%	na	0.22	
opaque wall u-value	0.057	0.057	
overall vertical u-value	0.154	0.170	wall + glazing
% difference from target UA		10.6%	if positive less stringent than code

-END OF MEMO